GEO 600 status and noise projection

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Holographic noise worskhop May 2009

Albert-Einstein-Institut
Hannover

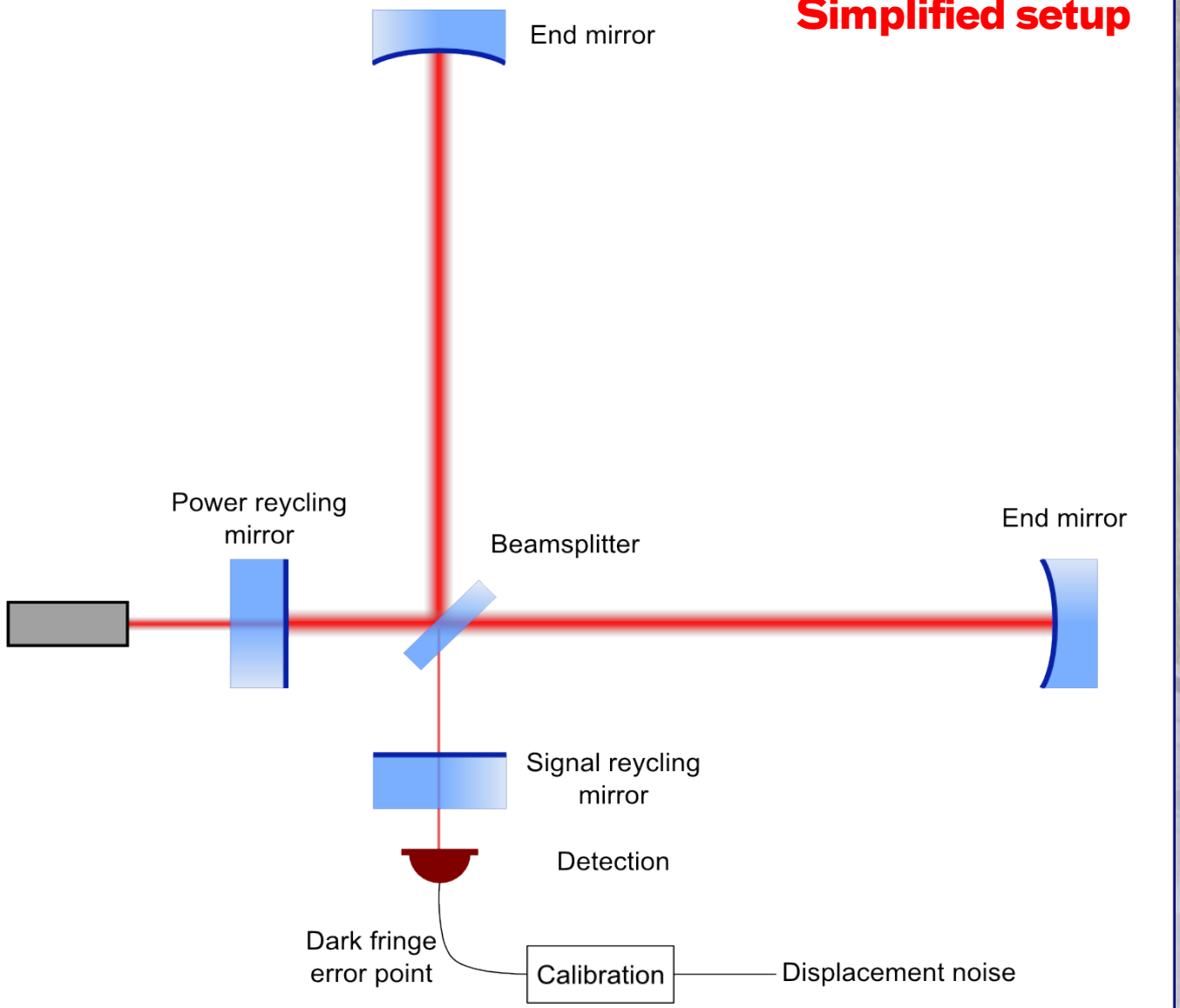
GEO 600

GEO 600 from the air

200m

(from Googlemaps)

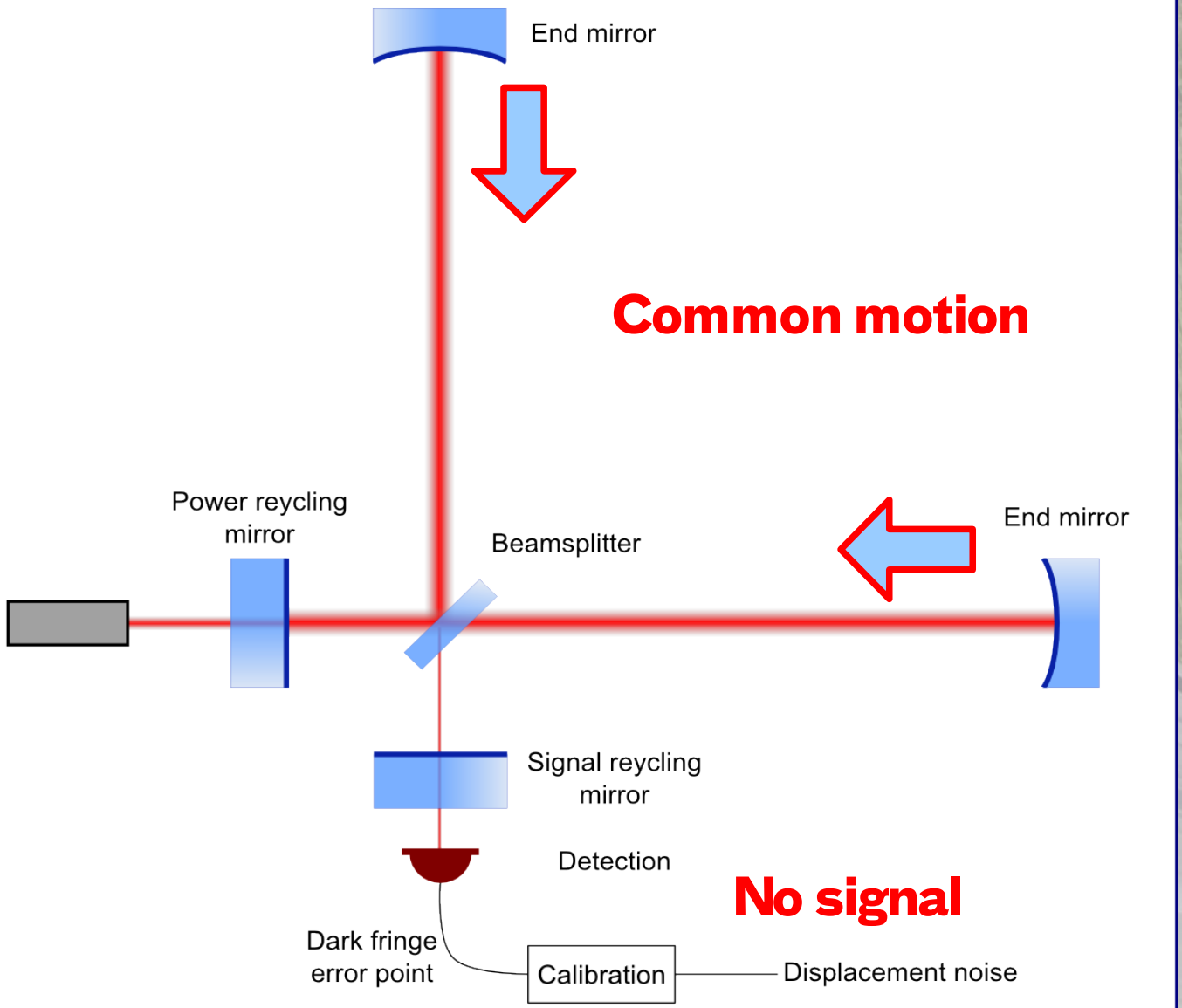
What do we measure ?



GEO600 is a gravitational wave detector

Sensitive to differential optical path difference change in the 2 arms

What do we measure ?



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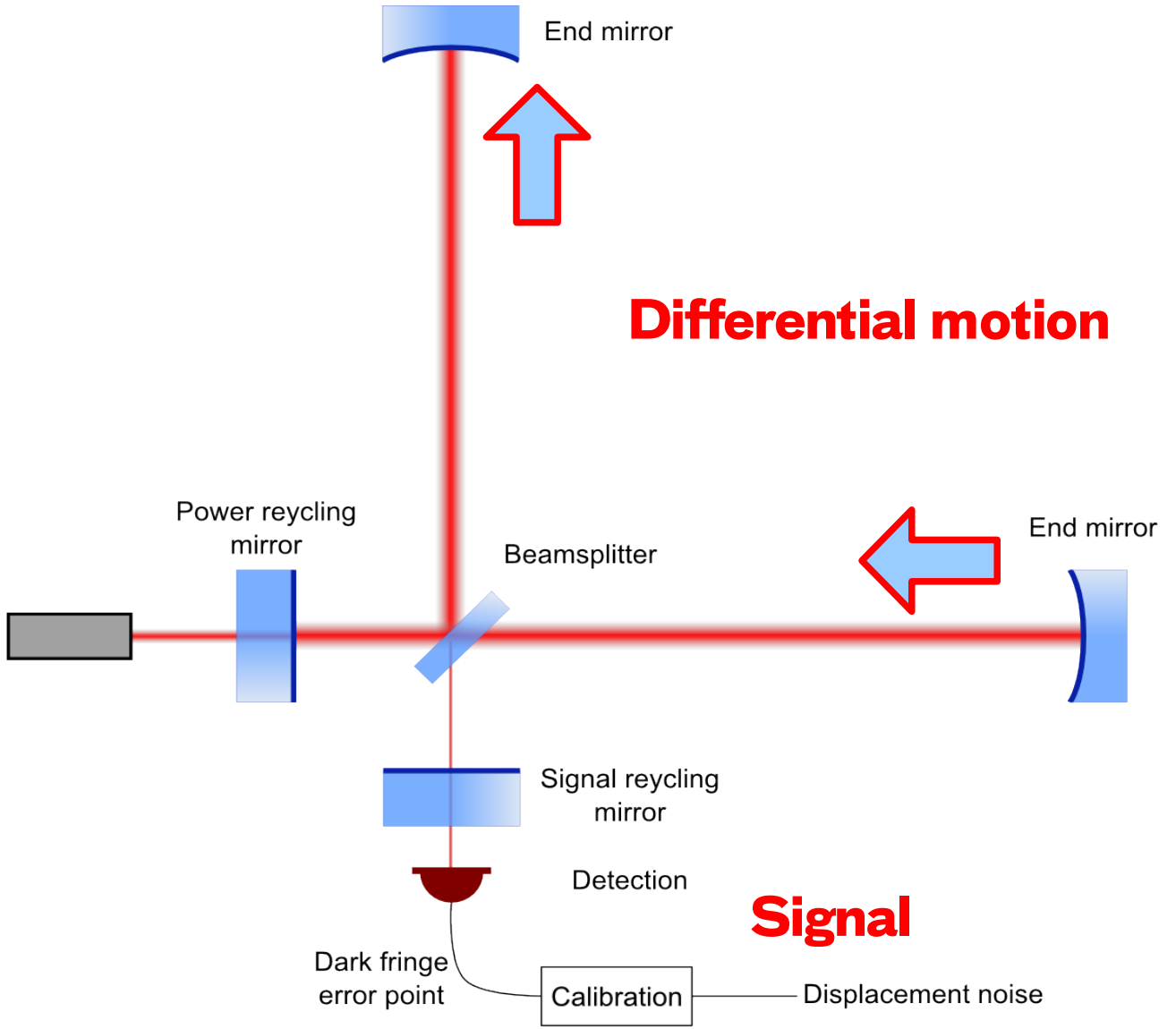


GEO600 is a gravitational wave detector

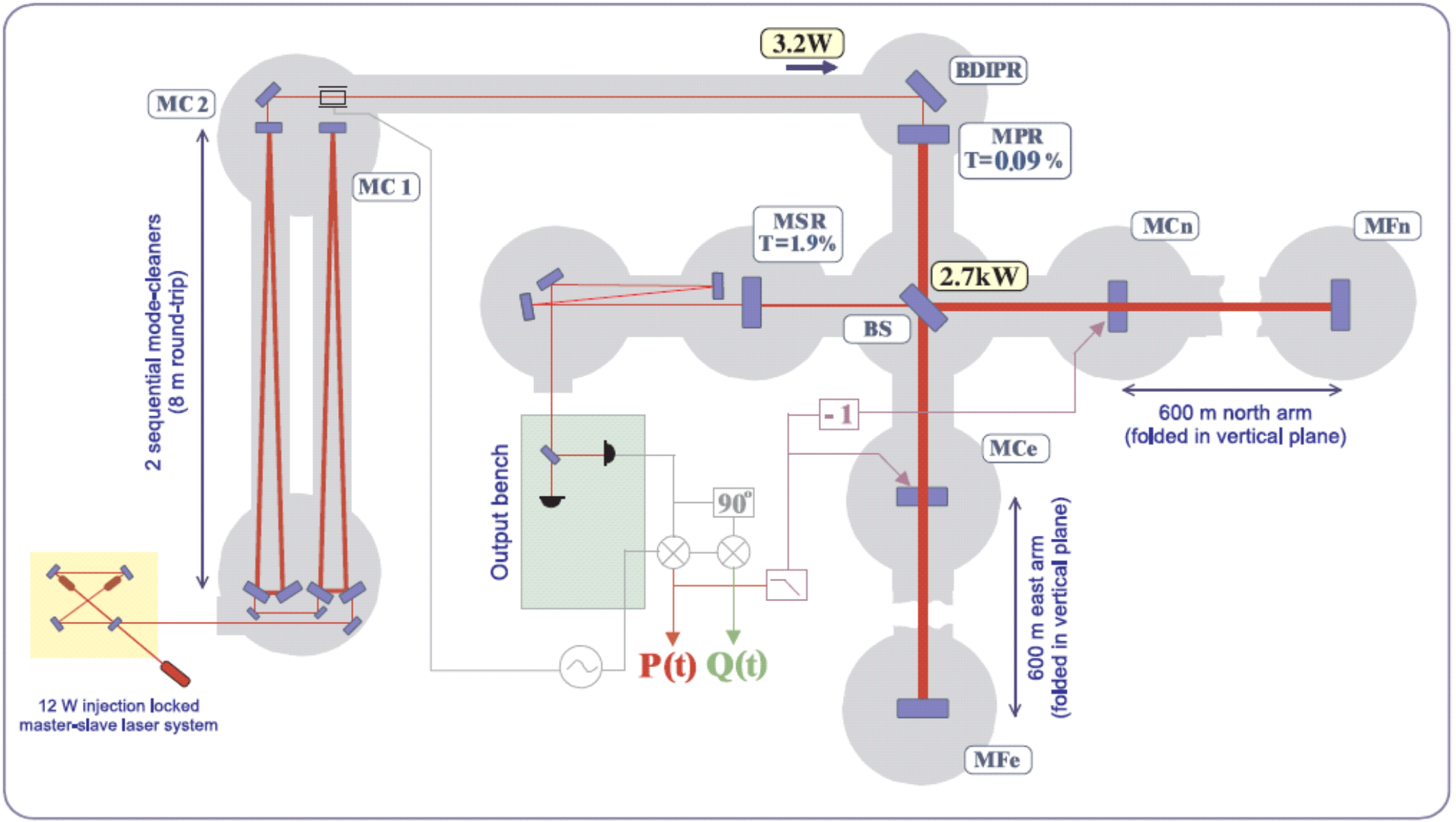
Sensitive to differential optical path difference change in the 2 arms

Compared to other GW detector:

- No FP arm cavities
- Signal recycling mirror

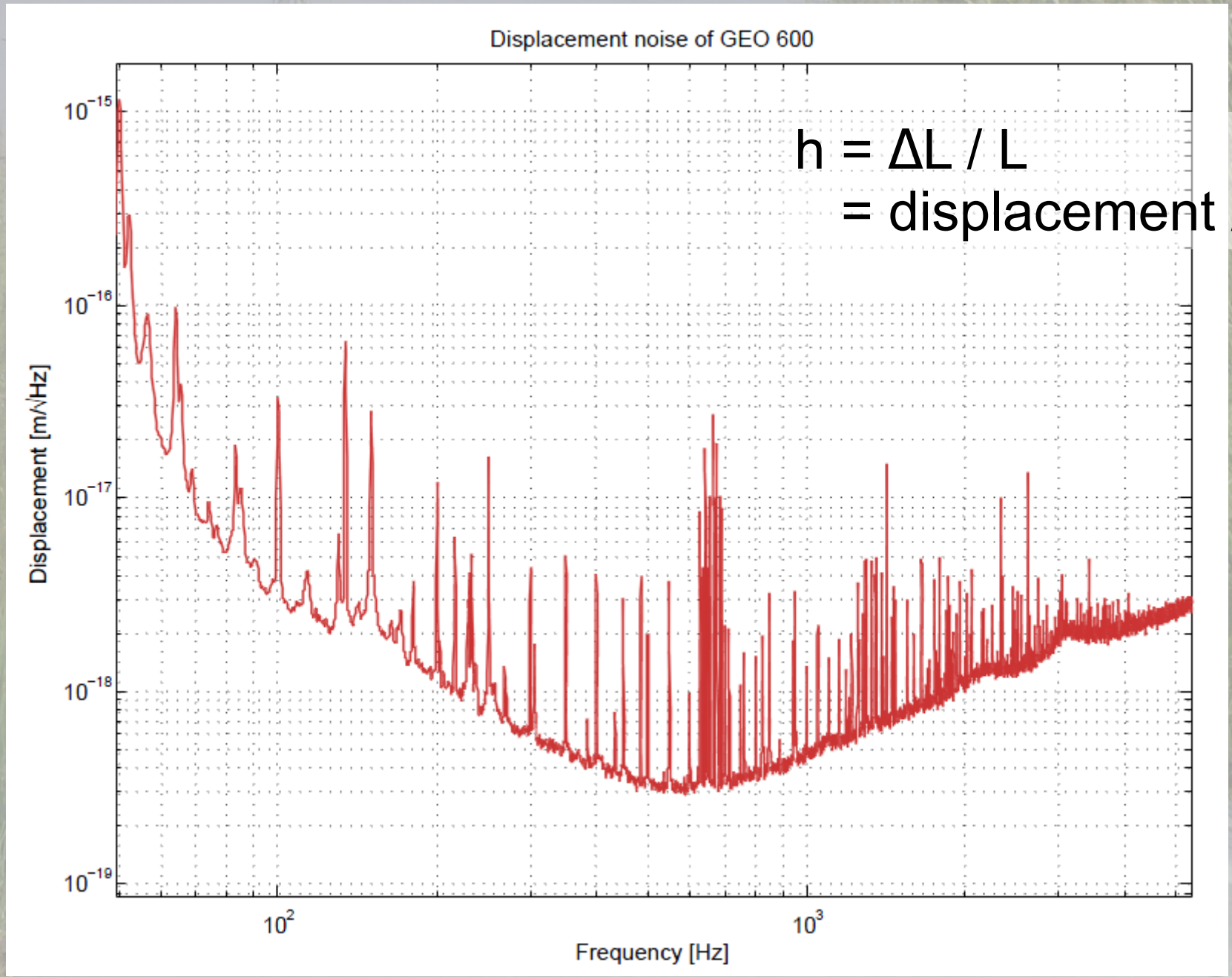
Optical setup

Dual recycled Michelson interferometer



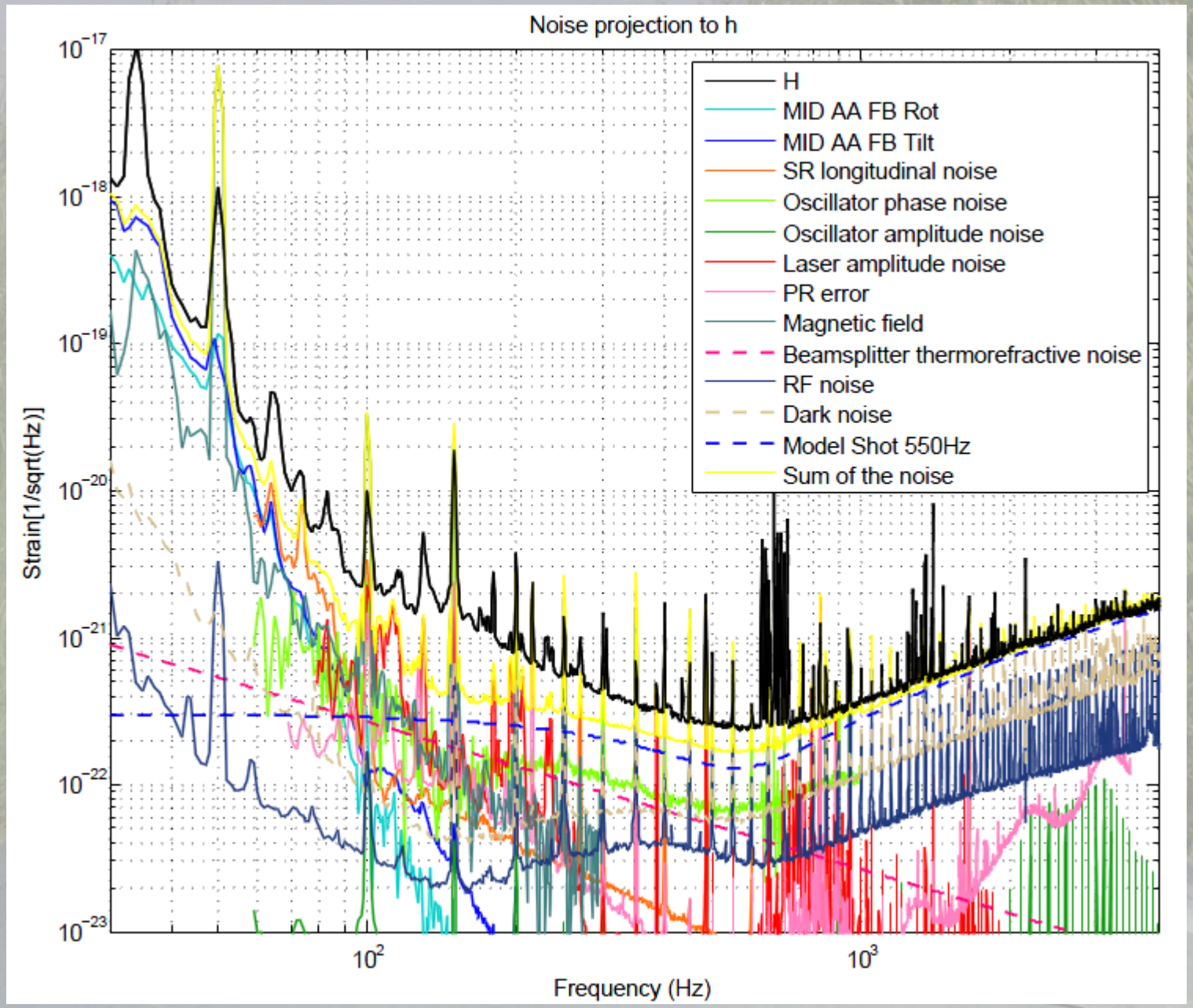
Inside the central lab

Displacement spectrum



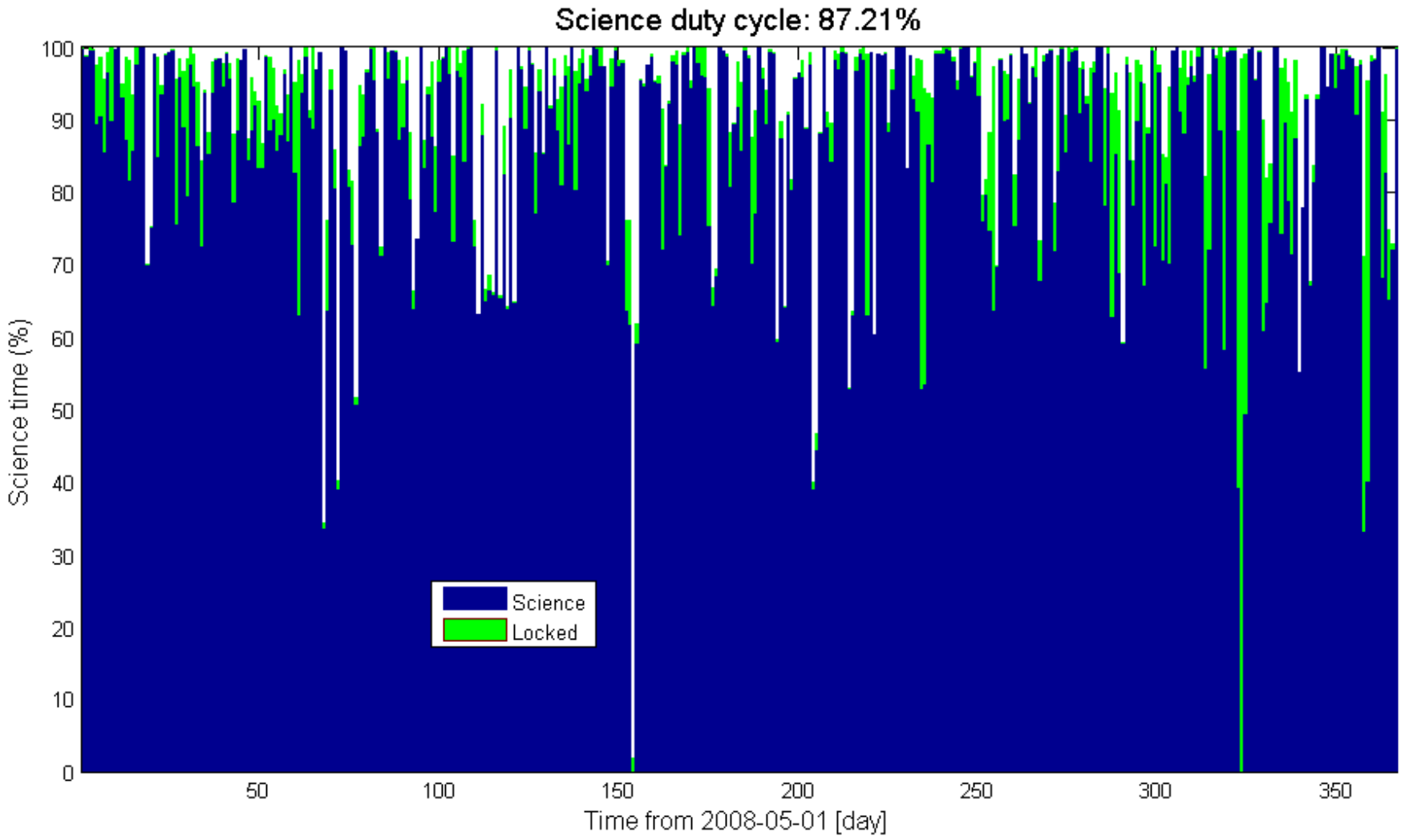
$h = \Delta L / L$
$= \text{displacement} / 1200$

The noise budget



Astrowatch

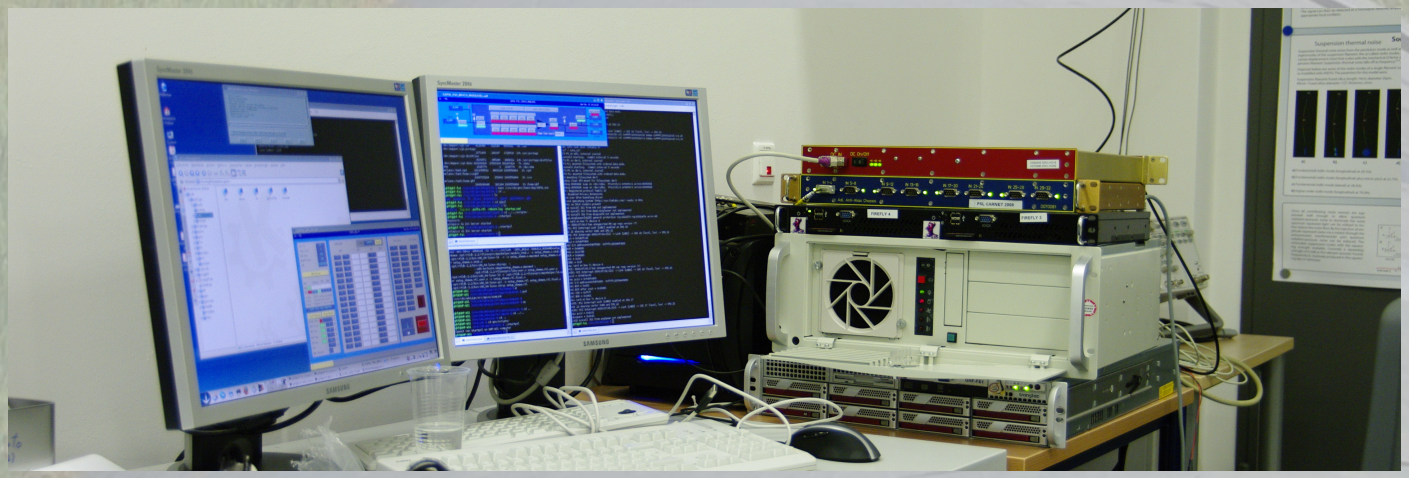
In astrowatch mode since November 2007

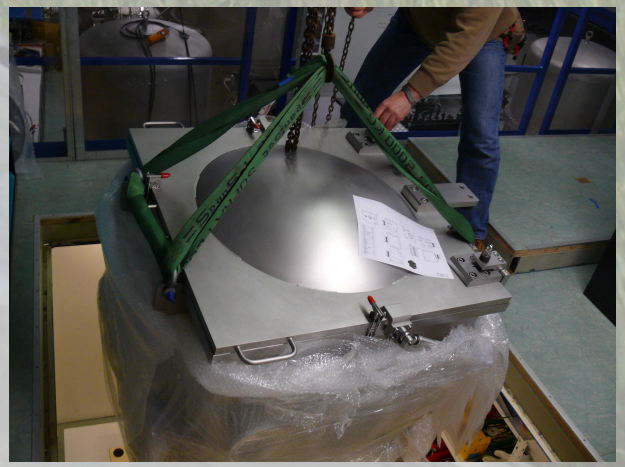


Current reasearch activities

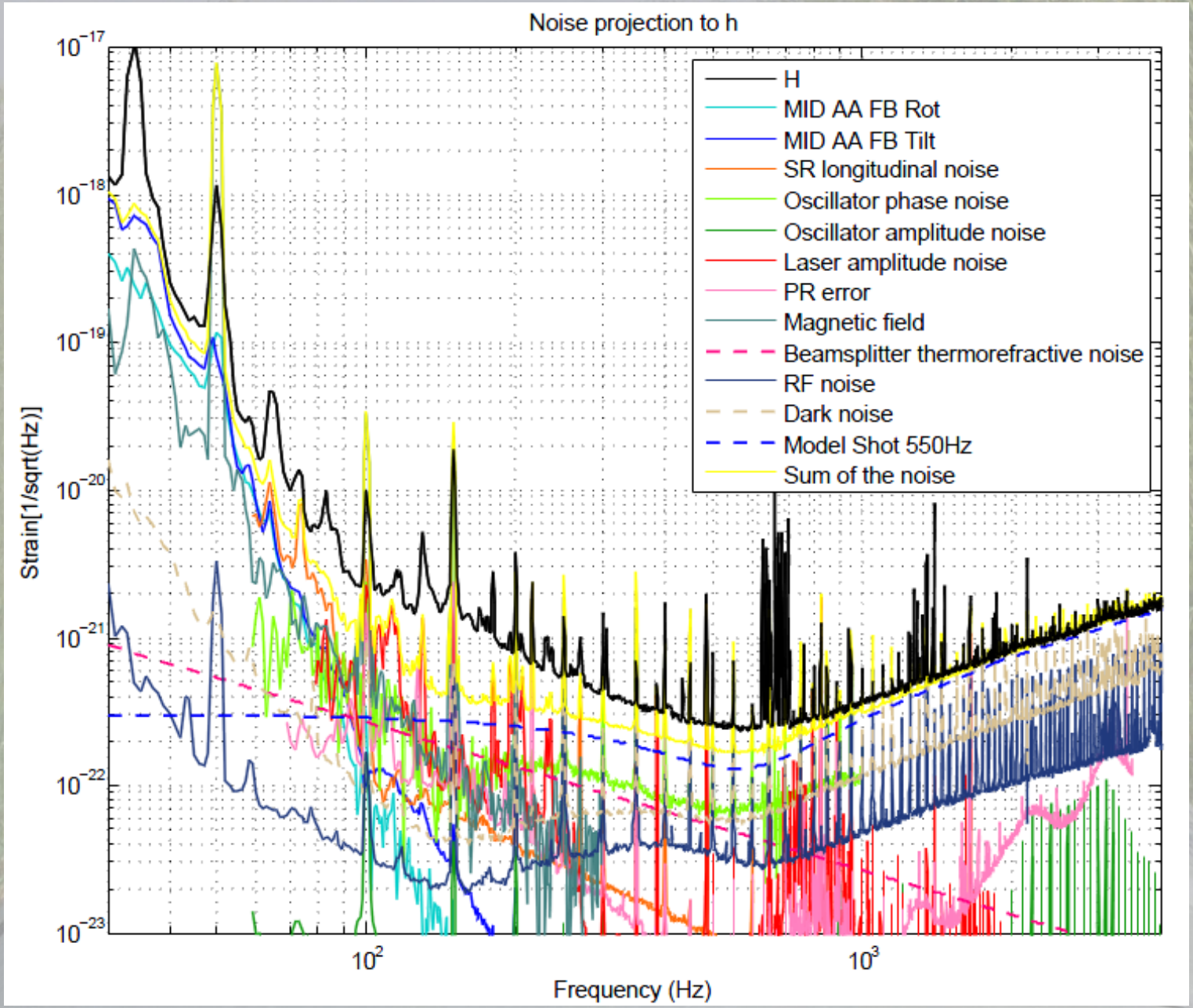
- Maintening the detector sensitivity
- Dedicated experiments regarding holographic noise (following talk)

- **Preparing for the next major upgrade** (following talk)
  - Testing DC readout implementation
  - Building output mode cleaner
  - New digital control system
  - New vacuum system with isolated plateform inside
  - Beamsplitter thermal lensing compensation





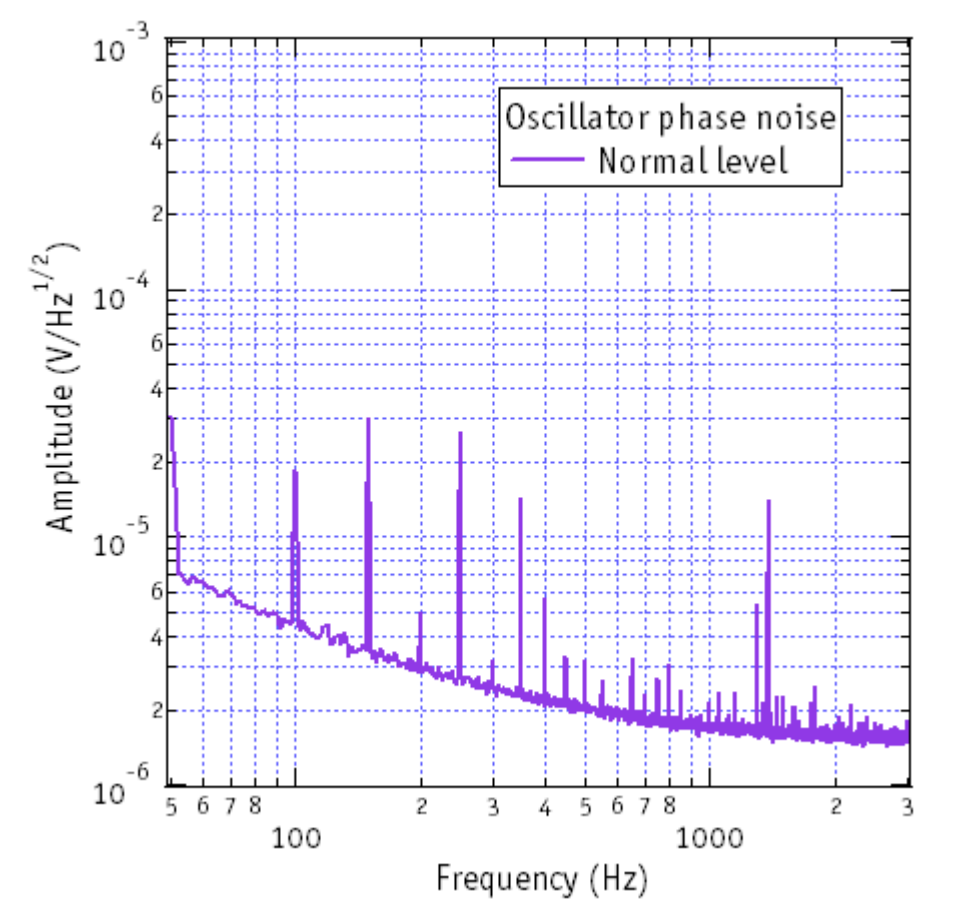
Part II: How to do this plot ?



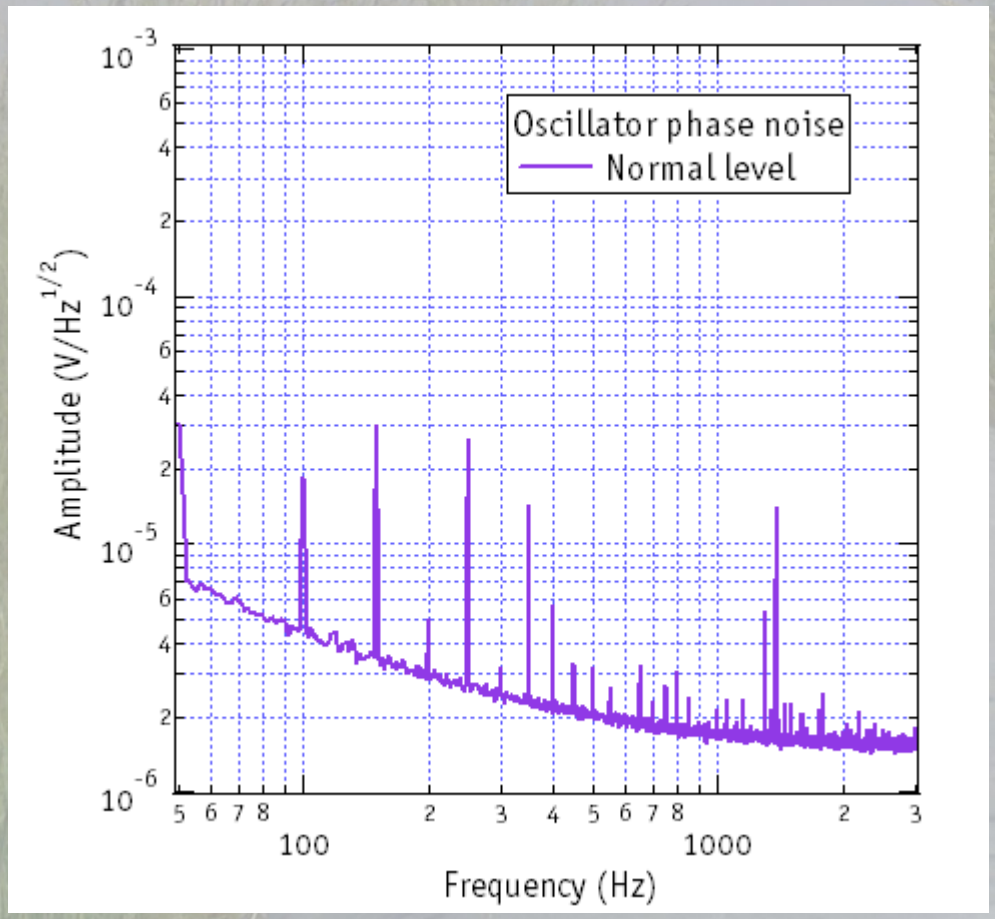
How to project noise ?

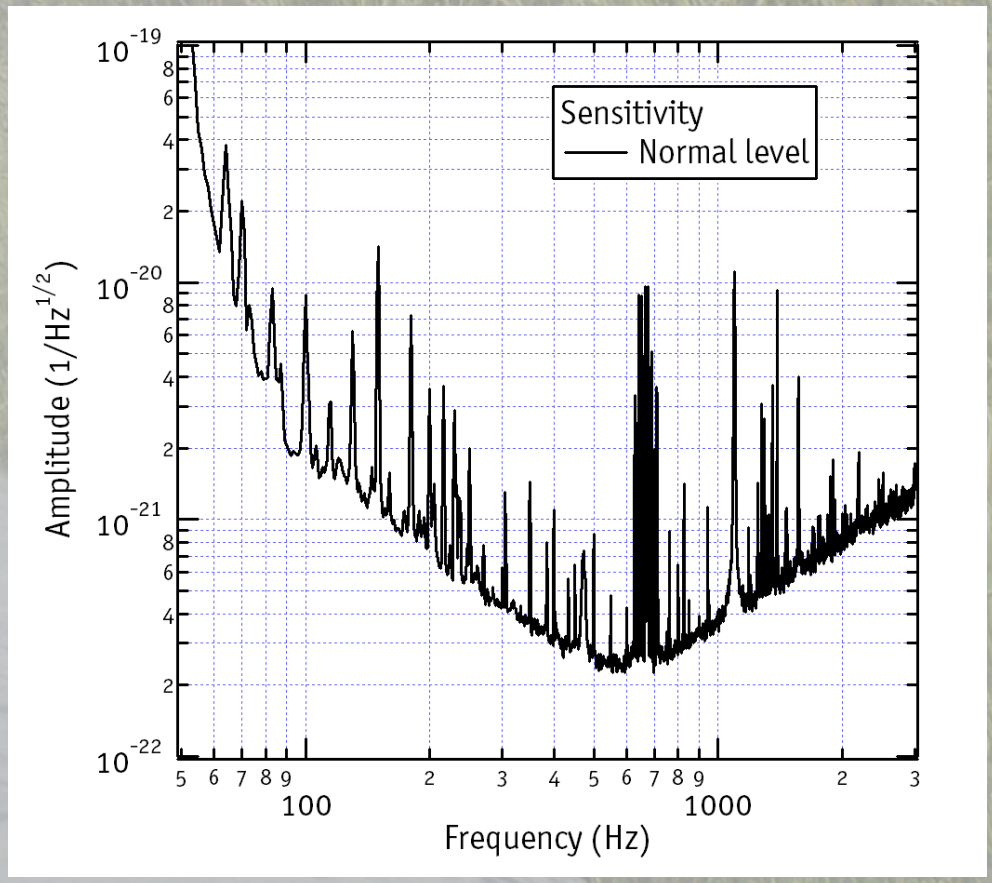
Be able to quantify the noise:

- direct measurement
- measure at the error point
- measure the feedback
- indirect measurement



How to project noise ?

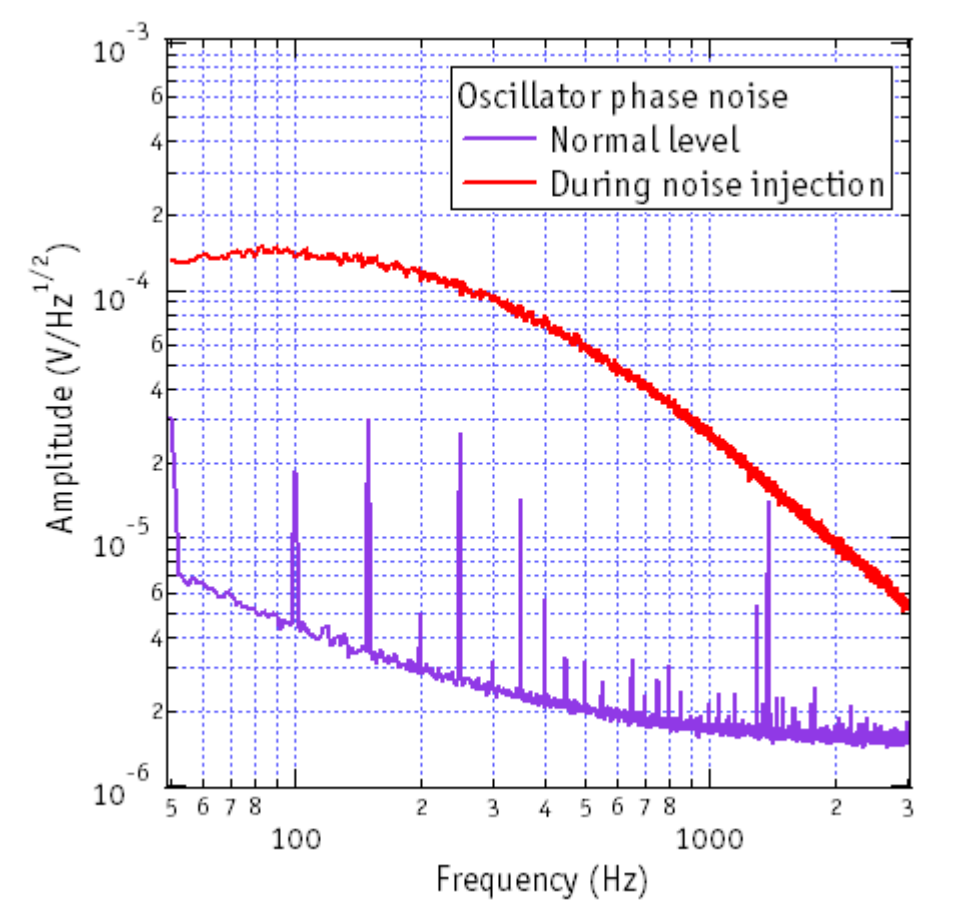


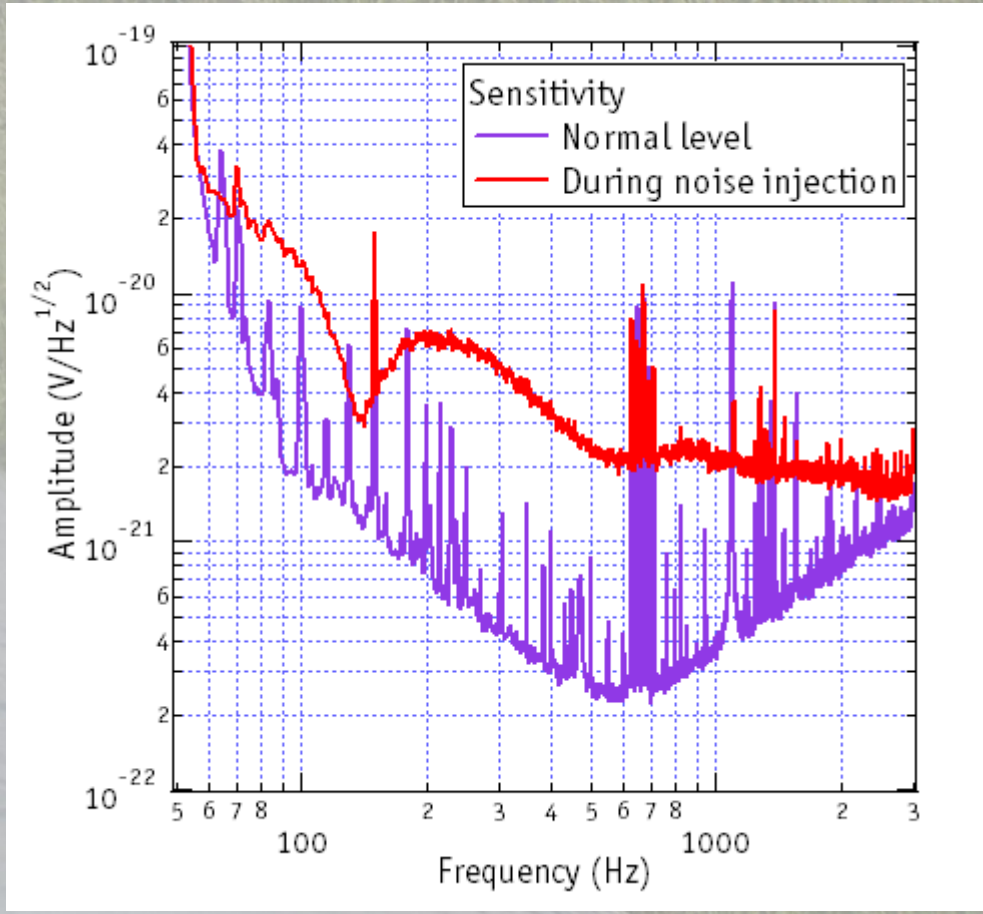


Contribution to h ???

How to project noise ?

Do a noise injection

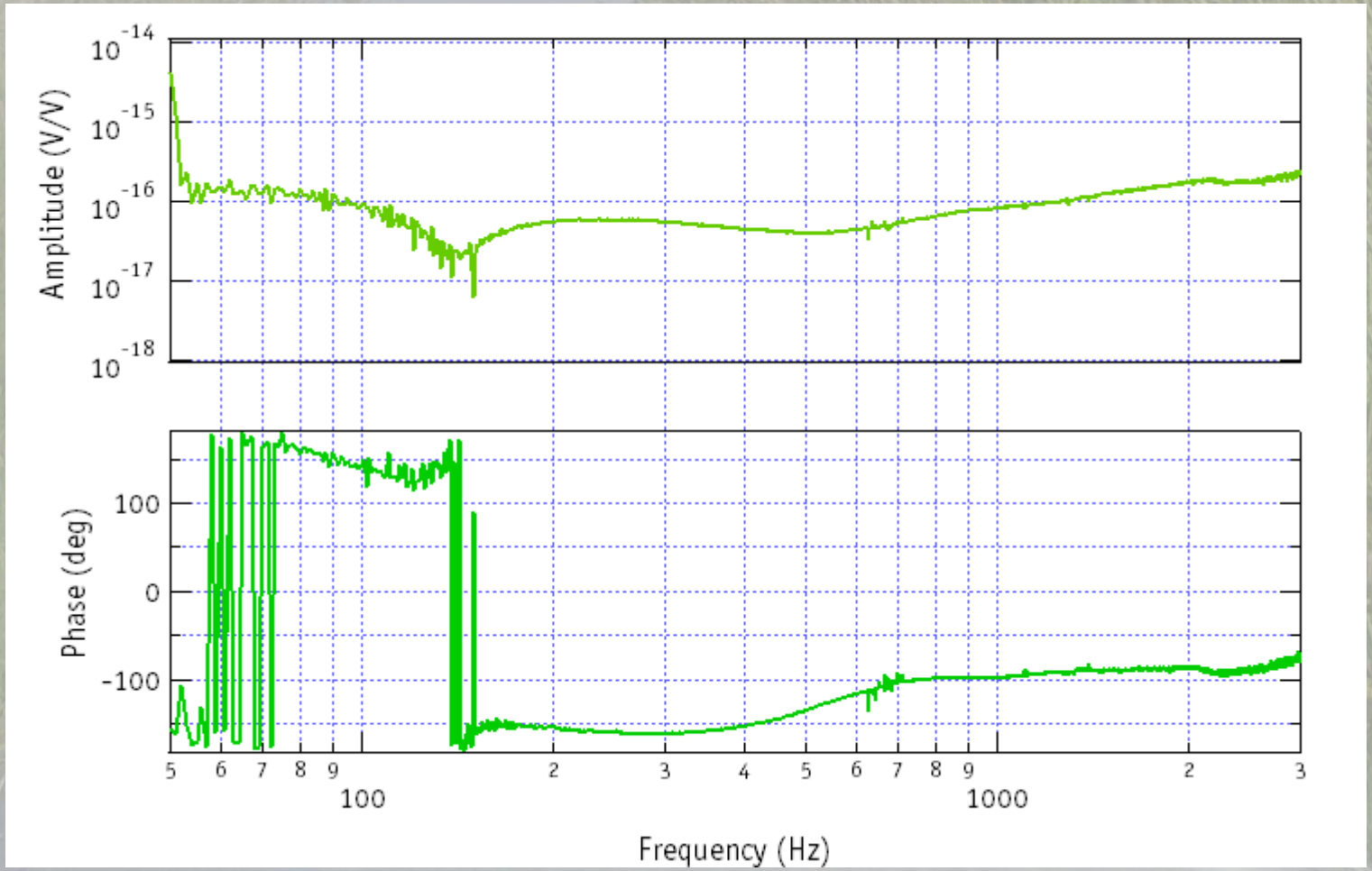




Transfer function only valid from 80 Hz up to 3 kHz
(transfer function supposed independent of the noise level)

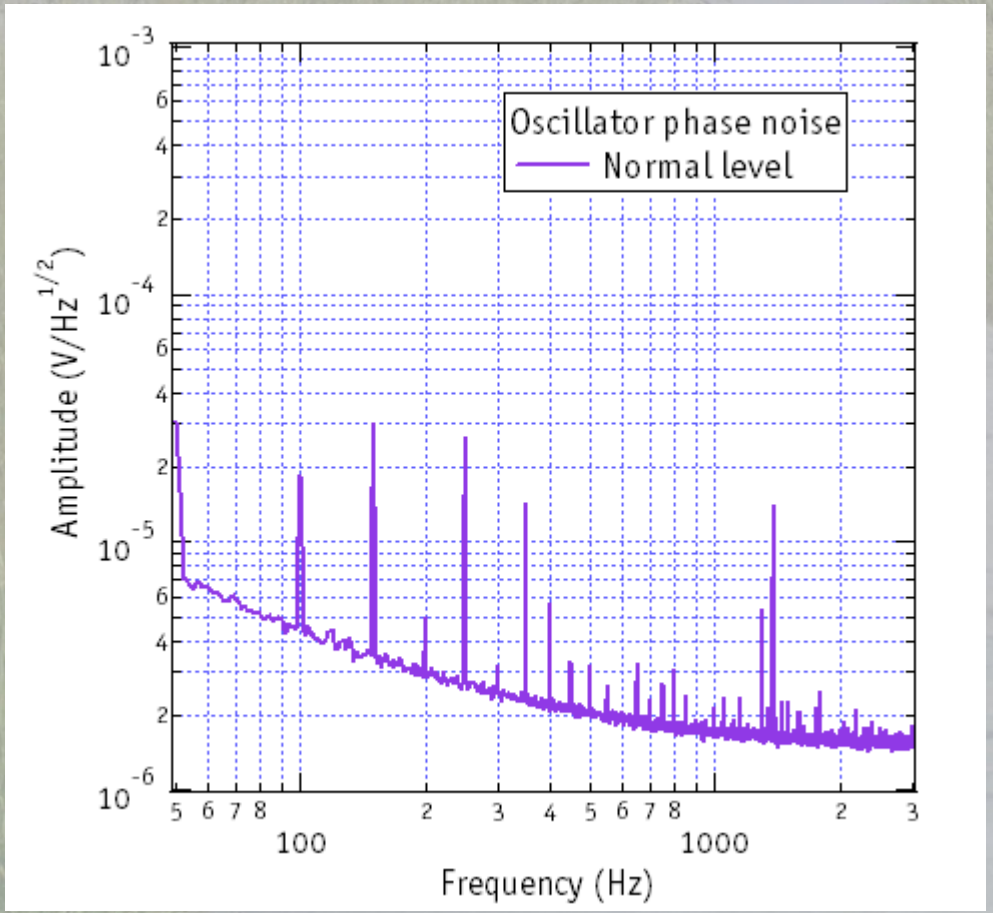
How to project noise ?

Calculate the transfer function: sensitivity/OPN

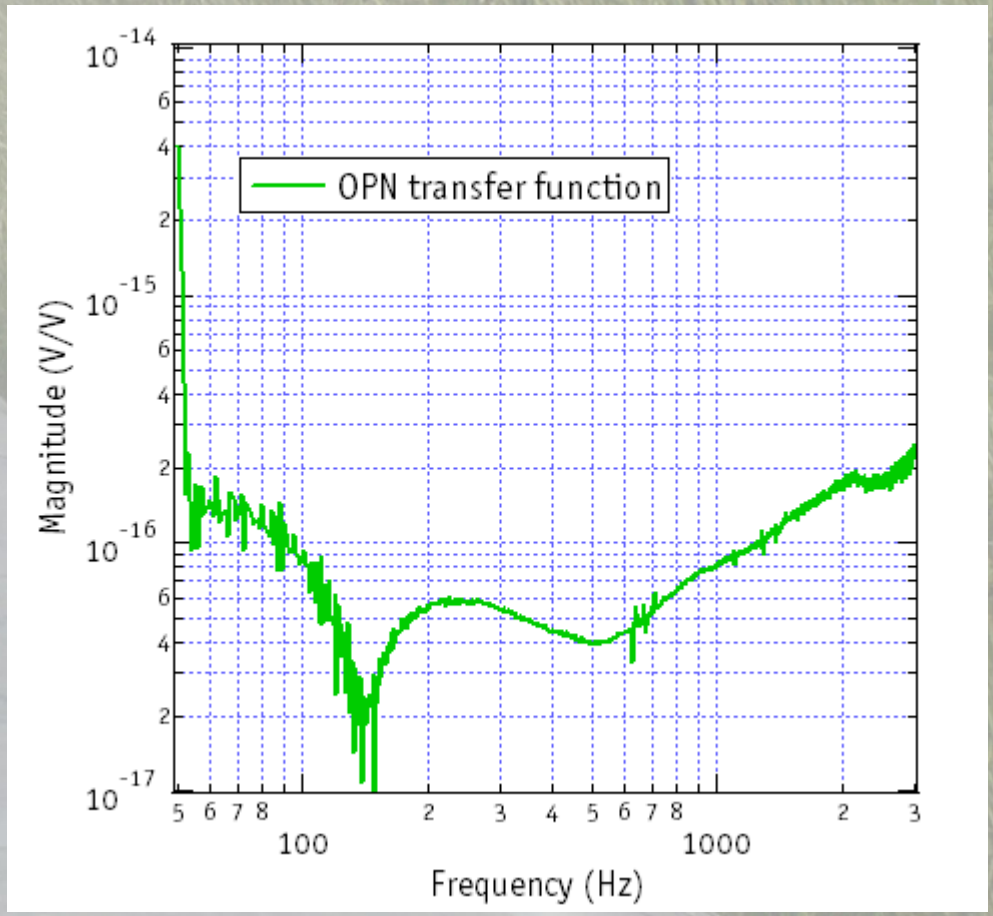


How to project noise ?

The last step:
multiply the noise by the measured transfer function:



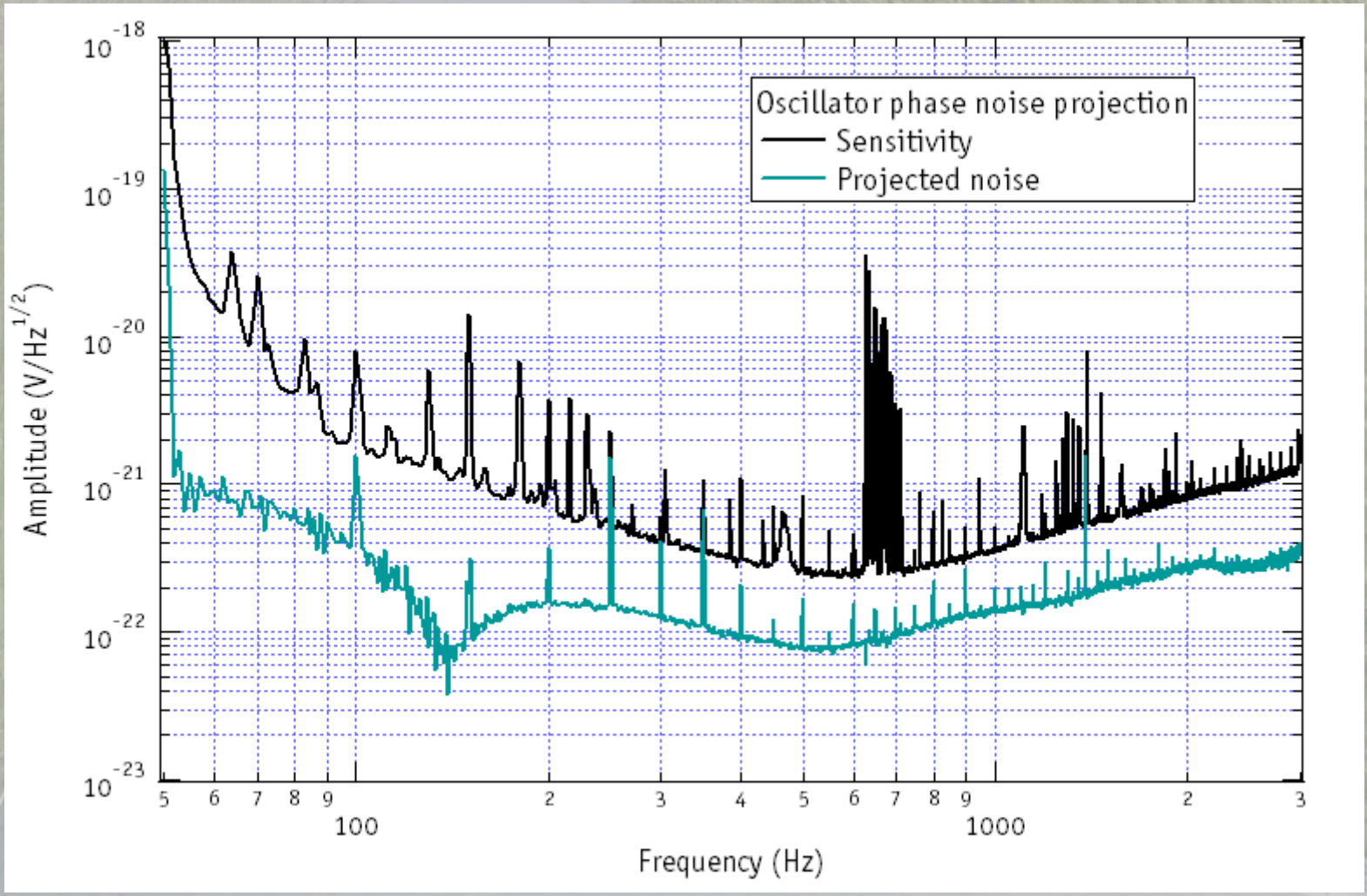
×



(transfer function supposed time invariant)

How to project noise ?

Noise projected to h



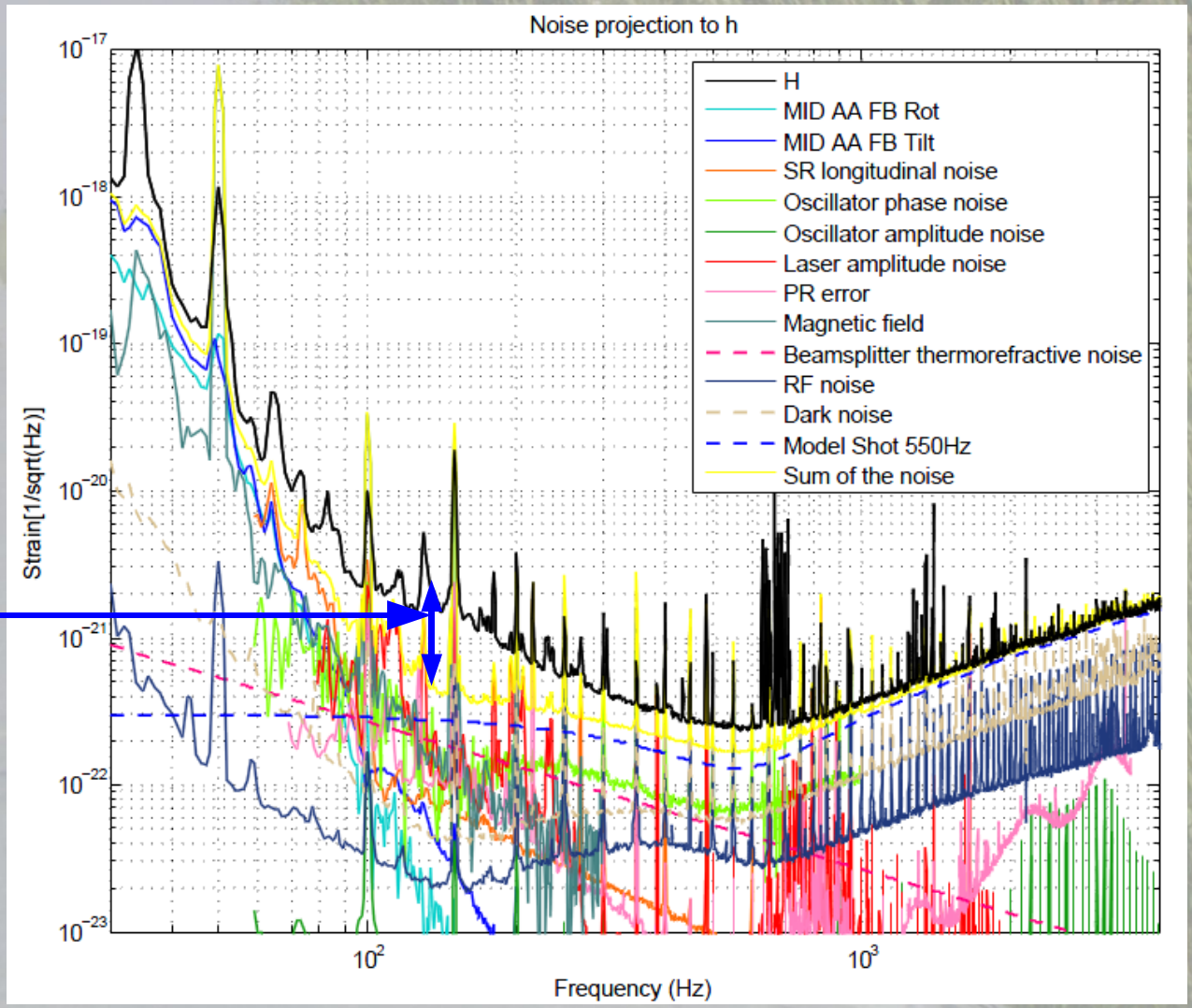
Sum all the noises

We suppose all the noise uncorrelated

In the frequency domain:

Sum_noise = $\sqrt{\sum noise^2}$

Mystery noise



Mystery noise